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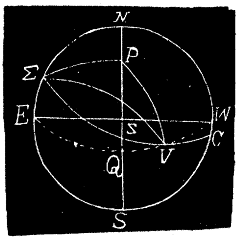
218, Art. 153, we have for the *hour-angle* of the Dog-Star, $t=\pm\cos^{-1}[-\tan\lambda\tan\delta],=74^\circ\ 10'\ 57.''77,=4h.\ 56m.\ 43.851s.$ The *sidereal* time of the rising of the Dog-star is, therefore, $\Theta=\alpha-t,=1h.\ 43m.\ 46.149s.,$ $=25^\circ\ 56'\ 32''.325.$

The problem now is to find on what day of the year the *Sun* will rise at the sidereal time of the rising of the Dog-Star.



In the accompanying diagram, let Σ represent the Sun just rising; $\angle VPQ=\Theta$; $QZ=\lambda$; $ZP=90-\lambda$; $VP=Z\Sigma=90^\circ$; $\angle PVE=90^\circ$; and $\angle\Sigma VE=23^\circ\,27'\,18''.82$. Now, $\angle PV\Sigma=66^\circ\ 32'\ 41''.18$; and from the spherical triangle PVZ, we deduce $\angle PVZ=25^\circ\,32'\ 24''$, and $VZ=48^\circ\ 30'\ 8''$. Obviously $\angle ZV\Sigma=90^\circ$ $-(\angle PVZ+\angle\Sigma VE)=41^\circ\ 0'\ 17''.18.$ From the spherical triangle $VZ\Sigma$, we deduce $\angle V\Sigma Z=29^\circ\ 26'\ 18''$, and $V\Sigma=131^\circ\ 25'\ 23''.4$. Now, $V\Sigma$ is the *longitude* of the Sun at the time the Dog-Star and the Sun rise together. With a mean daily motion of $59'\ 8''.3302$, the Sun reaches this longitude $133\frac{1}{3}$ days immediately succeeding the *twenty-first* of March, or on the *first* day of August.

This problem can be solved in *four* different ways; and some of the results of these solutions indicate the *second* day of August as the required date.

22. **Proposed by F. P. MATZ, D. Sc, Ph. D, Professor of Mathematics and Astronomy in Irving College, Mechanicsburg, Pennsylvania.**

From what kind of dry wood must a ship's log be cut, in order that the log may float with its center of gravity at the water's surface?

I **Solution by B. F. BURLESON, Oneida Castle, New York, and the PROPOSER.**

The ship's log, a *circular sextant* in form, floats with the *convex* part immersed. If the central semi-angle be α, the portion of the log *not* immersed is αr^2. Consequently, the portion of the log immersed, becomes,

$$A=(\alpha-4\sin^2\alpha\tan\alpha/9\alpha^2)r^2\ldots.(1).$$

If $\frac{1}{G}$=the specific gravity of the log,

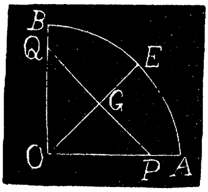
$$\frac{1}{G}=\frac{9\alpha^3-4\sin^2\alpha\tan\alpha}{9\alpha^3}=1-\frac{8\sqrt{3}}{\pi^3}=.5531096,$$

which, according to *Hutton's* Table of Specific Gravity of Bodies, is the specific gravity of Dry *Fir*; and, according to *Scribner's* Table of the Specific Gravity of Bodies, is the specific gravity of Dry *White Pine*.

II **Solution by G. B. M. ZERR, A. M., Ph. D, Vice President and Professor of Mathematics and Sciences in the Texarkana College, and Conservatory of Music, Texarkana, Arkansas.**

Taking the "log" in the shape of a quadrant of a circle and supposing it to float with the arc down, let G be the center of gravity ρ=density of the wood, 1.026 the density of the sea-water. Then $OG=\frac{4r\sqrt{2}}{3\pi}$, $OP=OQ=\frac{8r}{3\pi}$.

$\therefore$ area $POQ=\frac{32r^2}{9\pi^2}$, area quadrant$=\frac{1}{4}\pi r^2$, area



$$QBEAPQ=\tfrac{1}{4}\pi r^2-\frac{32r^2}{9\pi^2},\quad \therefore 1.026\left\{\tfrac{1}{4}\pi r^2-\frac{32r^2}{9\pi^2}\right\}=\tfrac{1}{4}\pi r^2\rho.$$

$$\therefore \rho=1.026\left(1-\frac{128}{9\pi^3}\right)=.5554.$$

This is the density of Juniper tree (dry) and very nearly the density of white pine (.554).

23. Proposed by G. B. M. ZERR, A. M., Ph. D., Professor of Mathematics in Texarkana College, Texarkana, Arkansas.

Pliny says, "Thales determined the cosmical setting of the Pleiades to have happened in his time 25 days after the vernal equinox". Determine the time when Thales lived from the following data:—Latitude of Miletus 37° 30′, the precession of the equinox 50″.34 anually, the R. A. of Alcyon (η Tauris) Jan. 1, 1895, 3h. 41m. 15 sec. declination 23° 46′ 49″ N.

Solution by the PROPOSER.

Let λ=latitude of Miletus, a, δ, t, a_1, δ_1, t_1, the R. A. declination, and hour-angle of Alcyon and the Sun respectively; ε=the obliquity of the ecliptic, ω=the distance the Sun has traveled on the ecliptic after the vernal equinox.

Then $\cos t=-\tan\lambda\tan\delta$....(1). $\cos t_1=-\tan\lambda\tan\delta_1$....(2). $\sin a_1=\tan\delta_1\cot\varepsilon$....(3). $a_1+t_1=a+t=\theta$, or $a_1=\theta-t_1$....(4). $\sin a_1=\sin(\theta-t_1)$....(5). From (3) and (5), $\sin(\theta-t_1)=\tan\delta\cot\varepsilon$....(6). From (2) and (6), $\tan\delta_1=\frac{\sin(\theta-t_1)}{\cot\varepsilon}=-\frac{\cos t_1}{\tan\lambda}$....(7). From (7)

$$\tan t_1=\frac{\sin\theta\tan\lambda+\cot\varepsilon}{\cos\theta\tan\lambda}\ \ldots.(8):$$

Also $\cot\omega=\cos\varepsilon\cot a_1$....(9). Now λ=37° 30′, δ=23° 46′ 49″, a=3h. 41m. 15 sec., ε=23° 27′ 13″. From (1), t=109° 45′ 43″.57=7h. 19m. 2.9 sec. $a+t=\theta$=11h. 0m. 17.91 sec.=165° 4′ 28″.57. From (8) t_1=106° 30′ 10″.94 =7h. 6m. 0.73 sec. From (4), a_1=3h. 54m. 17.18 sec.=58° 34′ 17″.7. From (9), ω=60° 43′ 28″.47.

In one day the Sun moves 59′ 8″.35. (59′ 8″.35)×25=24°38′ 28″75. 60° 43′ 28″.47−24° 38′ 28″.75=36° 4′ 59″.72=129899″.72. 129899″.72 ÷50″.34=2580.44+years. 2580.44−1894=686.44 B. C., when Thales determined the cosmical setting of the Pleiades. 60o 43′ 28″.47÷59′ 8″.35 =61.6085 days after vernal equinox. 61.6085−25=36.6085. 59′ 8″.35÷50″.34=70.48768 years. 79.48768×36.6085=2580.448+. 2580.438−1894 =686.448 B. C.

Also solved by *F. P. MATZ.*